

Pick and Choose

Reporting Category Patterns, Functions, and Algebra
Topic Exploring properties of real numbers

Materials

- Chart paper
- Markers
- Properties of Real Numbers Sort sheet (attached)
- Scissors
- Properties of Real Numbers handout (attached)

Vocabulary

operation, equation (earlier grades)

identity, inverse, reciprocal, property, real number (6.19)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Prior to the lesson, write the identity property for addition, the identity property for multiplication, the multiplicative property of zero, and the inverse property for multiplication on chart paper, putting each property on a separate piece of paper.

1. Introduce the lesson by explaining to students that they will be exploring the properties of operations with real numbers. Explain the mathematical meaning of the word *property*, and review the meaning of *real number*.
2. Have students complete each of the three activities presented below.
3. After students have completed all three activities, distribute scissors and copies of the Properties of Real Numbers Sort, and have pairs of students complete it. Circulate around the room, and check each pair's sort.
4. Have students complete the Properties of Real Numbers handout individually.
5. Discuss with the class each of the properties, and discuss how properties of operations with real numbers are helpful in real life.

Activity A: Identity Properties for Addition and Multiplication

1. Write the word *identity* on the board. Ask students to think about what it means to have an identity. Allow students time to talk this over with partners, and have students share their responses.
2. Explain that the identity properties are numbers that when combined with other numbers do not change the other numbers. Ask students to think about how this idea relates to what they just discussed. Display the chart papers with the two identity properties labeled.

Point out that there is an identity property for addition and an identity property for multiplication.

3. Ask students what number could be used for the identity property for addition—that is, what number, when added to any other number, does not change the value of the original number. Have students test different numbers to find which number fits the identity property for addition. Have a discussion of student responses. If they do not identify zero as the number, tell them that when zero is added to any number, the number remains the same. Have them revisit their work and test using zero to see whether they agree. Write a description of **the identity property for addition** on the chart paper along with some examples: “The sum of any real number and zero is equal to the given real number (e.g., $5 + 0 = 5$).”
4. Ask students what number could be used for the identity property for multiplication—that is, what number, when multiplied by any other number, does not change the value of the original number. Have students test different numbers to find which number fits the identity property for multiplication. Have a discussion of student responses. If they do not identify 1 as the number, tell them that when 1 is multiplied by any number, the number remains the same. Have them revisit their work and test using 1 to see whether they agree. Write a description of **the identity property for multiplication** on the chart paper along with some examples: “The product of any real number and one is equal to the given real number (e.g., $8 \cdot 1 = 8$).” As you write examples, use the symbol (\cdot) for multiplication throughout the lesson.

Activity B: Inverse Property for Multiplication

1. Write the word *inverse* on the board. Talk to students about the meaning of this word, reviewing the meaning of *inverse operations* from the “Balanced” lesson. Tell students that *inverses* are numbers that combine with other numbers and result in identity elements.
2. Display the chart paper with the inverse property labeled. Point out that students will be exploring the inverse property for multiplication.
3. Have students brainstorm what numbers could be used as factors with other numbers to have a product of 1. Provide students with a few examples, such as $4 \cdot \square = 1$ and $\frac{1}{3} \cdot \square = 1$.

Have students generate ideas as to how to find the multiplicative inverse of a number. Have a discussion of student responses. Explain that the multiplicative inverse of a number is also referred to as the *reciprocal* of the number. Note that zero has no multiplicative inverse. Write a description of **the inverse property for multiplication** on the chart paper along with some examples: “The product of a number and its multiplicative inverse (or reciprocal) always equals one (e.g., $4 \cdot \frac{1}{4} = 1$).”

Activity C: Multiplicative Property of Zero

1. Display the chart paper with the multiplicative property of zero labeled. Ask students to make predictions about what the multiplicative property of zero might be. Discuss student responses.

2. Explain that any real number multiplied by zero is equal to zero. Have students come up with examples to support this property. Write a description of **the multiplicative property of zero** on the chart paper along with some examples: “The product of any real number and zero is zero (e.g., $4 \cdot 0 = 0$).”

Assessment

- **Questions**
 - How are the identity properties for addition and multiplication the same?
 - How are the identity properties for addition and multiplication different?
 - What is the result of multiplying any real number by zero?
 - Do all real numbers have a multiplicative inverse? How do you know?
 - Why is it important to know about properties of real numbers?
- **Journal/Writing Prompts**
 - Explain why zero has no multiplicative inverse.
 - Describe at least one of the properties of real numbers, and provide examples of the property.
 - Describe how knowing properties of real numbers may help you in real life.
- **Other**
 - Have students glue their Properties of Real Numbers Sort onto a piece of paper to be used as an assessment.
 - Use the Properties of Real Numbers handout as an assessment.
 - Provide equations that are examples of the various properties, and have students match the equations with the properties.
 - Have students write “Properties Poems” to present to the class.
 - Have students create “Properties Slide Shows,” using software, to present to the class.
 - Have students create a chart of the properties, including a definition of each property, pictures of objects illustrating each property, and an example and a non-example of each property.
 - Have students play the game “Four Corners” with one of the four properties placed in each corner of the room. As you display an equation, students walk to the corner that has the correct property.

Extensions and Connections (for all students)

- Have small groups of students create matching activity games to share with other small groups. Give each group a stack of index cards on which to list the properties of real numbers. Then, have them write corresponding numerical examples on other index cards. Have them exchange stacks of cards, shuffle them, and play a matching game to match each property to its numerical example.
- Invite an accountant to visit the classroom to discuss how properties of real numbers are important to his/her job.
- Visit a bookkeeper or cafeteria manager to discuss how properties of real numbers are important to his/her job.

Strategies for Differentiation

- Provide students with index cards describing each of the properties and including examples to use throughout the lesson.

Properties of Real Numbers Sort

Cut out each of the cards. Place each equation under the correct property.

$0 + 6 = 6$	Inverse property for multiplication
$7 \cdot 1 = 7$	Multiplicative property of zero
$4 + 0 = 4$	Identity property for addition
$190 + 0 = 190$	Identity property for multiplication
$4 \cdot \frac{1}{4} = 1$	$\frac{2}{3} \cdot \frac{3}{2} = 1$
$6 \cdot 0 = 0$	$0 \cdot 678 = 0$
$1 \cdot 90 = 90$	$1 \cdot \frac{1}{2} = \frac{1}{2}$
$0 \cdot 56 = 0$	$\frac{1}{2} \cdot 2 = 1$

Properties of Real Numbers

Name _____ Date _____

Label each equation with one of the four properties listed below.

Identity property for addition
Identity property for multiplication
Inverse property for multiplication
Multiplicative property of zero

1. $986 \cdot 1 = 986$ _____

2. $0 \cdot \frac{1}{2} = 0$ _____

3. $\frac{4}{5} \cdot \frac{5}{4} = 1$ _____

4. $0 + \frac{1}{2} = \frac{1}{2}$ _____

5. $56 \cdot \frac{1}{56} = 1$ _____

6. $87 + 0 = 87$ _____

7. $87 \cdot 0 = 0$ _____

8. $1 \cdot \frac{5}{8} = \frac{5}{8}$ _____

9. Write your own equation, and label it with the correct property.
